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ILLUSTRATED LECTURE ON
ORCHARD MANAGEMENT

By

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Forestry, States Relations Service

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SYLLABUS 23—ILLUSTRATED LECTURE ON ORCHARD MANAGEMENT.¹

By H. M. CONOLLY, *Assistant in Agricultural Education*, and E. J. GLASSON, *Specialist in Horticulture and Forestry, States Relations Service.*

INTRODUCTION.

This lecture treats especially of all the practices which have to do with the growing of the tree and its fruit. The more thoroughly these practices are carried out, the more successful the orchard will be.

Some of the more important practices in orchard management are tillage, maintenance of soil fertility, pruning, and spraying. If the orchard has been started right, the management problems are much simplified and chances for success well assured, but if the orchard was given a poor start and has been much neglected, the problems become complicated and success is more uncertain.

Climatic and soil conditions vary in different sections of the country and even in different locations in the same section of country. These differences in conditions make necessary different methods of accomplishing the results that are desired. It is very essential, therefore, to determine what practices can best be used and adopt those which most closely suit the conditions under which the work is to be done.

LOCATION AND SITE.

The foundation of a profitable orchard is a desirable location, a suitable site, and proper varieties. The location of an orchard has to do in general, with its geographical position

¹ This syllabus has been prepared by cooperation between the Office of Horticultural and Pomological Investigations of the Bureau of Plant Industry, as regards subject matter, and J. M. Stedman, Farmers' Institute Specialist of the States Relations Service, as regards pedagogical form. It is designed to aid farmers' institute and other extension lecturers in presenting this subject before popular audiences. The syllabus is illustrated with 50 lantern slides, as listed in the Appendix. The numbers in the margins of the pages refer to the lantern slides as listed in the Appendix.

View. or place on the map, and in detail concerns its relation to shipping stations, transportation facilities, markets, economic conditions, in some cases the sequence of the ripening of fruits compared with other locations, climatic conditions, and other factors of less importance.

The site has to do with the exact piece of land occupied by the orchard. It concerns chiefly the soil, topography, relative and actual elevation, and local climatic conditions with reference to frosts. Emphasis is placed on relative elevation because of its influence on the occurrence of frosts.

Location.—Some of the features that should be carefully considered under location are the roads and the distances over which fruits and supplies must be hauled. Rough roads with steep grades in sections where there is no immediate prospect of improvement will make it almost impossible to produce fruit at a profit. Long hauls are expensive, and rough roads cause serious damage to the fruit; and where there is close competition with more favorable locations the profits are apt to be very small.

Transportation facilities are important. When orchards are not within wagon or truck haul of the market, the railroad facilities should be carefully considered. Not only must the train service be adequate, but the securing of refrigerator cars when needed and the icing of the same at reasonable rates are necessary in shipping perishable fruit.

The markets to which fruit will be shipped must be accessible without much delay in transit. Where transfers are numerous, and roundabout connections with branch lines of railroads must be used, delays are frequent and rates are high, thus considerably increasing the expenses.

The economic conditions, such as the procuring of suitable labor and the facilities for the care of this labor, must be taken into account.

The climate must be considered in selecting the kinds of fruit to grow in a locality or region, for it is usually unprofitable to attempt to grow fruits in any region that are not adapted to the conditions under which they are planted.

Site.—Among the items to be considered under the site is the soil. The soil should be deep with a porous substratum which will allow excess water to seep away quickly. If the soil is run down it is not in good condition for the growth of orchard trees.

Land that is gently rolling is to be preferred to land that is either very rough and uneven or very steep. Erosion is apt to be very heavy on steep land, and the expense of orchard

operations is heavy in comparison with what it is where the view.
conditions are favorable.

If the relative elevation, or elevation as compared with the surrounding country, is high, it provides for good air drainage and good soil drainage. Air drainage is very essential, for it provides conditions under which frosts are less apt to occur, and under which fungus diseases are more easily controlled. A well-drained soil is almost imperative for the proper growth of fruit trees; therefore, if the site for an orchard is not well drained or capable of being well drained at little expense, it is a waste of time and money to use it for orchard purposes.

The climate of a particular site with reference to frosts should be considered, for it is very difficult to produce fruit profitably in sections subject to severe freezes or in sections where late spring frosts occur annually.

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PLANTING THE ORCHARD.

Systems of planting.—Where the site consists of steep slopes, the orchard should be laid out with reference to the contour of the land. The rows should be made in such a way that erosion of the soil will be reduced to a minimum, and that tillage, spraying, and harvesting operations may be conducted with the greatest possible ease.

The distance for planting is governed by the kinds of fruit to be grown, the habit of growth of the variety, and the fertility of the soil. Peaches may be planted from 18 to 22 feet apart, pears about 24 feet apart, and apples 30 to 40 feet apart.

Mixed plantings, such as apples and peaches, are sometimes profitable, but the management problems are less complicated when each fruit is planted by itself. Each variety should be planted in a separate block to facilitate harvesting, but a block which contains a self-sterile variety should be located near a block which contains a variety that is a good pollenizer.

Selection of varieties.—A great measure of the success with an orchard depends upon the proper selection of the varieties of fruit to be grown. This selection of varieties requires considerable care, and it is always well to find out what varieties do best in the particular locality, and also to consult the best authorities in the State. The number of varieties to be grown will depend upon the purpose, whether for home use or for market, and upon the kind of fruit. Where the purpose is to have a succession of ripe fruit over a long period, a greater number of varieties may be used than where the

View. ripe fruit is desired over a short period of time. The number of varieties of one kind of fruit is often influenced by the quantity of other kinds of fruit which ripen at the same time. In many sections the number of varieties grown for market is limited by the heavy shipping period of other regions.

Kind of trees to plant.—Only trees that are thrifty and well-grown and which have good roots and tops should be planted. Thrifty, well-grown trees need not be the largest trees to be found in the nursery, but often medium-sized trees will be as desirable as the larger ones. The smaller grades in many cases consist of trees which are weak and stunted, and often the root systems may be very poor. Though the small trees may be bought at a lower price than the medium-sized or large ones, they may prove costly in the end, especially if they lack the vitality necessary to make a good growth after being planted.

Apple, plum, pear, and cherry trees are commonly planted as 2-year-olds; that is, after they have made two seasons' growth in the nursery, though many growers prefer 1-year-old trees, especially apple and cherry. Peaches are invariably planted as 1-year-olds.

Nursery trees should always be packed in such a way that the roots will not dry out, and upon delivery at the place where they are to be planted they should be unpacked immediately. Unless the trees can be planted at once, they should be heeled in. A place that is well drained, with a deep mellow soil, should be selected for heeling in the trees. A trench is dug of sufficient width and depth to receive the roots, and the trees are carefully placed in this trench. Trees that are tied in bundles should be separated before heeling in, and the earth should be worked around the roots of each tree to prevent drying to any serious extent.

Preparation for planting.—Thorough preparation of the soil is just as important for planting an orchard as for planting corn or wheat. Deep plowing and thorough harrowing are very essential. It is a very good plan to grow some cultivated crop on the land the year preceding the setting of the orchard. This crop will not only put the land in better mechanical condition, but if a leguminous crop, it will increase the plant food in the soil. Preliminary to digging the holes for the trees, many growers plow one or two furrows as deep as practicable along the line where the tree row is to go. This plowing saves considerable digging when planting the trees.

Setting the trees.—Success in planting trees is made possible by avoiding unnecessary exposure of the roots and by thorough

firming of the soil about the trees. Puddling the roots is a common practice where the roots are apt to be exposed during planting operations.

In preparing the tree for planting all bruised or broken roots should be cut off, and all excessively long roots should be pruned back to correspond with the rest of the root system. The holes for the trees should be large enough to admit the roots without bending and crowding, and deep enough so that when filled the trees will be 2 or 3 inches deeper than they were in the nursery. The trees should be set with a slant toward the direction of the prevailing winds. After the trees are set they should be pruned back. One-year-old trees are usually cut back to a single stem 18 to 30 inches high, but if the trees are very large three or four short stubs are left at the top of the main stem so as to insure the growth of branches at the point where it is desired to form the head of the tree. Two-year-old trees should have short stubs left which are carefully selected to form the scaffold limbs of the trees.

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SOIL MANAGEMENT.

Tillage.—Tillage is beneficial to the soil in several ways. It improves the condition by increasing the depth and by fining the soil; it conserves moisture by increasing the water-holding capacity and by checking evaporation; it increases plant food by promoting nitrification and by hastening the decomposition of organic matter.

There are three methods of soil management with reference to tillage; namely, clean tillage, clean tillage with cover crops, and sod mulch. Clean tillage consists in keeping the soil throughout the orchard in a good state of cultivation until midseason and then stopping all cultivation. With this method of tillage the orchard is plowed as soon as the soil is workable and then harrowed as often as necessary to preserve a dust mulch on the surface of the soil.

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Clean tillage with cover crops consists of clean tillage until midseason, and then seeding the orchard down with a cover crop like rye, clover, etc. The cover crop is plowed under the following spring, and tillage given as in the previous year.

The sod-mulch system consists in seeding the orchard down to grass or clover. During the season this crop is mowed several times, and the material is scattered about the trees to form a mulch. In a great many orchards, where the land is so rough and rocky that cultivation is impracticable, weeds and other herbage are allowed to grow and this material is cut during the season and used as a mulch about the tree.

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View. There are differences of opinion as to the best methods of tillage in an orchard. Some growers adhere strictly to the clean-tillage system, others to the clean tillage with cover crops, and still others to the sod mulch. We should not claim that any one system of tillage is best, for each has its own adaptations. Many orchards will give good results under the sod-mulch system for a while and then would be very much benefited if clean tillage was given for a few seasons. Conditions should govern the plan of tillage to follow. If the grower keeps in mind the benefits to be secured by tillage and understands the principles involved, he can decide on the plan which best suits his needs.

Maintenance of fertility.—It is always better to maintain the soil in a highly fertile state than to permit it to become depleted to such a degree as to become unproductive. Good tillage and the maintenance of a good supply of humus will keep the soil in suitable condition for fruit growing. Where stable manure is plentiful, there is probably no better way of supplying humus than by the liberal use of it. Where manure is not available, cover or green-manure crops are to be advised.

Cover crops.—There are two main groups of plants used for cover crops, namely, leguminous and nonleguminous. The first group comprises such plants as red, crimson, and bur clover, cowpeas, soy beans, alfalfa, vetch, peanuts, and velvet beans. The second group includes rye, oats, buckwheat, millet, rape, and turnips.

Cover crops improve the soil in several ways. They improve the physical condition of the land by preventing the soil from cementing together or puddling, by holding rains and snows until they can soak away, and by drying out the soil in the spring, making possible early tillage. They catch and hold leaching nitrates, add humus to the soil when plowed under, render plant food available, and collect nitrogen if they are legumes.

Where it is intended to omit tillage for a season, orchards are very commonly seeded down to red clover. Crimson clover is used quite extensively as a winter cover crop in the orchard, especially on the lighter soils throughout New Jersey, Delaware, and Maryland. It gives excellent results, particularly in seasons when there is a good supply of moisture in the soil at planting time. Vetch is very widely planted in the northern fruit regions, and alfalfa in the apple orchards of the States west of the Great Divide. Cowpeas and soy beans are very widely planted in the middle and southern latitudes, and velvet beans in the extreme south.

Rye is probably the most widely planted of all the non-leguminous cover crops. It can be sown very late in the season, it germinates when very little moisture is available, and it lives over winter, starting into growth early in the spring. Rye and vetch in combination have been found very satisfactory in many instances.

View.

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Fertilizing.—Fertilizing the orchard may be accomplished in two ways. Fertilizing materials may be applied directly, in the form of commercial fertilizer or stable manure, and indirectly, by growing cover crops. A careful study of the growth of the trees from year to year is necessary for intelligent fertilizing. Young trees usually need considerable quantities of nitrogenous fertilizers in order to make wood growth, while bearing trees require considerable quantities of phosphate and potash. It is impossible to give any definite formulas for fertilizing trees without knowing all the conditions.

Irrigation.—Much of the fruit west of the one hundredth meridian is grown under irrigation, but in the other regions little attention is given to it. Where irrigation is practiced, the drainage should be carefully looked after and all the phases of irrigation thoroughly studied.

PRUNING.

There are several different results to be obtained by pruning, namely:

1. To keep the tree within bounds, so that the work of spraying and of picking the fruit can be done with the greatest facility.
2. To remove dead or interfering branches.
3. To open the top of the tree to admit air and sunshine, and to reduce the struggle for existence among the branches.
4. To thin the fruit and stimulate the development of fruit buds.
5. To make the tree stocky and increase its vigor.

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There are differences of opinion as to the best ways of pruning to secure the results desired, but most successful growers admit that regular pruning is desirable. Each grower in pruning his trees has in mind the securing of some definite objects, though he may not know just what the principles of pruning are. Each tree furnishes a problem in itself, but if the principles are understood these problems can be solved.

After a tree is planted it is headed back to a single unbranched stem or a stem with several branches, depending on the size and age of the tree. The second season several of these stubs or new branches are selected to form the scaffold limbs

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View. of the tree. Care should be taken to have these three or four spread out well along the main stem so as to avoid bad crotches later. The branches selected are headed back 10 or 12 inches.

26 The third season two or three branches are allowed to remain on each of these scaffold limbs, and all others cut off. The branches selected this time should be located so as to balance evenly and keep open the top of the tree. The fourth season the operation is repeated on the limbs of the preceding season's growth. In all later prunings care should be used to save fruit spurs and keep the bearing wood low and well distributed throughout the tree.

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In pruning, all cuts should be made close to the parent branch, leaving no stubs which might later decay back and injure the tree. All wounds of more than an inch in diameter should be painted.

The correct principle seems to be to do the least cutting possible and yet get the results desired. A great deal of the cutting done in winter may be avoided by a little judicious pinching back of buds during the summer. This pinching back prevents the growth of branches that must be removed later and permits better growth in the branches that are desired.

THINNING.

The purpose of thinning is to reduce the quantity of fruit which a tree sets to a quantity that it can mature and at the same time develop fruit buds for the next year's crop. An excessive crop usually means small and often poorly colored fruit, and the overloading frequently breaks down the limbs of the tree. The development of seeds is an exhaustive process on a tree, and the growth of seeds in small fruits is as depleting as in the case of large fruits; thus thinning relieves the tree of a severe strain. In the case of winter apples it is quite likely that annual bearing is encouraged by thinning, for it gives more opportunity for the development of fruit buds. Summer varieties of apples require several pickings, and each of these pickings may in a way be called a system of thinning. With stone fruits, especially peaches, thinning has become an established practice among most commercial growers. How much and when to thin depends on conditions. The usual time of thinning is just after the so-called June drop. The amount to thin varies with the kind of fruit and the variety. With some varieties it is not always profitable, and the extra drain on the tree by the production of seed can be overcome by fertilizing.

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32 Peaches are usually thinned to about 5 or 6 inches apart on the limbs.

REJUVENATION.

Many orchards contain trees which, owing to old age, neglect of pruning, insects, or disease, have become unprofitable. All of these trees which are vigorous can be renovated, and their usefulness prolonged a number of years. High-headed trees with their bearing wood at the extremities of long branches are not only difficult to spray, but the work of picking the fruit is troublesome and expensive. Such trees may be headed back and the fruiting wood brought within convenient reach. Trees like peaches may be cut back to a few short arms near the trunk, and the tree allowed to form an entirely new head. With apples and pears severe heading is not to be recommended. With old trees, where the head is so high that in order to materially reduce the workable height the branches would have to be nearly all cut away, it is questionable whether the renovation is profitable.

Old trees which are vigorous and which are of varieties that are not desirable may be headed back and the tops grafted into desirable varieties. This top-working is done by budding in the case of peaches and by cleft grafting in the case of other kinds of fruit trees. The new top is formed as low down as is consistent with the vigor of the tree and the size of the branches.

In all renovation or rejuvenation of fruit trees there is more to be considered than just pruning and top-working. Old orchards have usually been neglected in regard to cultivation, spraying, and fertilizing, as well as pruning. After the trees have been deheaded and all rubbish in the orchard cleared up and burned, a good spraying with lime-sulphur should be given. This spray will kill any scale insects that may be in the orchard and will help to clean up the trees. Whenever the season permits, the land can be broken and clean culture given. If the orchard has been in sod for a number of years, and especially with some leguminous crop, the soil will probably contain a good deal of vegetable matter; but if not, then this material may be supplied by giving the land a good dressing of stable manure. An application of 300 pounds of acid phosphate and 150 pounds of muriate or sulphate of potash per acre, scattered around under the outer extremities of the limbs and between the rows and harrowed in, will be very beneficial to the production of good crops of fruit.

SPRAYING.

Purpose.—The purpose of spraying is to prevent or control the attacks of insects and fungus diseases, which lower the vitality of the tree or cause serious damage to the fruit. The

View.

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View. practice is based upon the principle that prevention is better than cure. When trees are sprayed they are covered with a thin coating of material which is unfavorable to the growth of pests. Thus the spraying is an insurance against injury rather than a cure after the injury has occurred.

42 The insects which trouble the orchardist may be grouped in two main classes, chewing insects and sucking insects. For the control of the first class some form of arsenic, such as arsenate of lead, is most generally used. The sucking insects can not be killed by poison, as they do not eat on the surface, so some preparation that will kill by coming in contact with their bodies is used. Lime-sulphur, kerosene emulsion, and a nicotine extract are very commonly used for the purpose.

43 There are two classes of diseases which trouble the fruit grower, fungi and bacteria. The fungus diseases may be controlled by spraying with lime-sulphur or Bordeaux mixture. For the bacterial diseases no satisfactory spray mixture has yet been found. Bacterial diseases, such as pear blight, can be controlled only by cutting out and burning the affected parts.

44 *Spray mixtures.*—There is no general spray mixture that can be applied to secure control over all orchard pests, neither is there a time of year when all the spraying work can be done. Insects and fungus diseases usually have a period in their development when they may be controlled by spraying. To secure the required control it is necessary to know the exact time to apply the spray, and also it is absolutely necessary to apply the right kind of spray. Care in making up the spray mixture to the required standard is very essential in all spraying work.

45 *Machinery.*—Spraying is a protection only in proportion as the object treated is thoroughly covered. It follows, therefore, that suitable implements must be employed in doing the work. Within recent years there has been a great improvement in machinery for spraying, and it is now possible to get a machine that is adapted to any phase of the work. A hand pump, with a barrel to hold the liquid, mounted on wheels, will serve for a few trees if they are not large. A tank mounted on a wagon, and a hand pump will answer all purposes in an orchard not exceeding 8 or 10 acres. For orchards exceeding 10 acres, especially where the trees are large, a machine operated by a gasoline engine or some other source of power will be found advantageous. A type of sprayer that is proving quite popular is the compressed-air sprayer. The noticeable feature about this machine is the absence of the pump and the engine.

A strong steel cylinder holds the liquid, and the power is supplied in the form of compressed air from a connecting tank. To use this type of sprayer it is necessary to have a large gasoline engine to operate a compressor, so that the compressed-air tanks may be recharged. Another type of sprayer is the dust sprayer, which is often used in districts where heavy vehicles can not be used and where water is scarce. The machines are supplied with a fan arrangement which blows the material in the form of a fine dust that entirely covers the tree. The dust method is useful mainly in controlling certain insects. Fungus diseases do not yield satisfactorily to this method as a rule.

Application.—In spraying it is necessary to have sufficient pressure and a suitable nozzle to break up the liquid into a fine mist and also force this mist over the entire surface of the object sprayed. In spraying for codling moth the spray must enter the calyx end of every little apple, and in spraying for San José scale every portion of the tree must be covered. Spraying is usually done with a pressure of at least 80 pounds, and in many cases this pressure reaches 150 pounds. It is very essential also in spraying to have suitable nozzles, so that the clogging can be reduced to a minimum, and to have extension rods, so that all points of the larger trees can be easily reached.

PROTECTION FROM RODENTS.

Very frequently young trees are attacked by rabbits, mice, woodchucks, and the like, and very serious damage is done. If the trees are still vigorous and the wounds not too extensive, the trees may be saved by bridge grafting. When young trees are set in districts where such rodents are numerous, it is a good plan to use some form of a tree protector. These protectors may be made of wood veneer, wire netting, lath, or tar paper. They should be set into the earth several inches, and run up on the trunk to cover up to the base of the scaffold limbs.

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TRAPPING DEVICES.

The codling moth is often trapped by using bands of burlap wrapped around the tree. The female insect crawls under this burlap to transform, and the bands may then be examined from time to time and the pupæ killed.

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The cankerworm may also be trapped by using sticky bands in place of the burlap. The females in crawling up the trunk of the tree become entangled in the sticky materials and are killed. Spraying is, however, the most satisfactory remedy for these two insects.

FIRE BLIGHT AND BORERS.

View. There are several troubles with which the orchardist has to contend that often become quite serious. These troubles are fire blight on apples and pears, yellows on peaches, and borers on peaches and apples. The only relief that can be had from fire blight is to cut out all infected branches as soon as observed. In cutting out these branches be sure to make the cut several inches below where the blight shows, and also gather up the cuttings and burn them. It is also essential to disinfect the pruning shears or knife in a solution of bichlorid of mercury or to treat the wound with the same solution. Soft and succulent wood growth seems to be more subject to attack, so where blight is prevalent the orchard should be seeded down and all nitrogenous fertilizers should be withheld. Peach yellows can only be checked by cutting out and burning all infected trees.

Peach-tree borers are generally controlled by mounding the trees and digging out the borers.

[The lecturer should always consult various publications for details on the different phases of orchard work. It is also advisable to obtain all publications that are available from the State experiment station and State department of agriculture of the particular State where the lecturer is working, for in this way he may obtain the best available information that is adaptable to his own region.]

APPENDIX.

LANTERN SLIDES.

No. of
view.

1. A deep porous soil.
2. A shallow soil underlain with rock.
Poor drainage is the result.
3. An apple orchard showing the effect of atmospheric drainage.
Trees in the background in bloom a week earlier than those in the hollow.
4. An orchard with an elevation from 1,600 to 2,100 feet.
The trees on the upper side of the orchard are retarded several days in blooming and ripening by the influence of the elevation.
5. Well-grown 1-year-old apple trees.
Very desirable for planting.
6. Well-grown 2-year-old apple trees.
7. Well-grown peach trees showing three different grades.
The medium size is usually to be preferred.
8. The proper way to plant a tree.
Using a planting board and firming the soil about the roots.
9. Peach trees of two different sizes pruned at time of planting.
10. A disk harrow—an excellent tool for orchard work.
11. Clean tillage in a cherry orchard.
12. Clean tillage in an apple orchard.
13. Sod mulch in an apple orchard.
14. Grass in an apple orchard being pastured down by sheep.
15. A peach orchard in which no system of tillage is practiced.
16. Alfalfa as a cover crop in an apple orchard.
17. Soy beans used as a cover crop in the orchard.
18. Rye used as a cover crop in a peach orchard.
19. A peach tree with a well-opened head.
20. Apple trees so loaded with fruit that props are necessary to prevent the breaking down of the limbs.
21. Peach trees which are 14 years old.
Note how proper pruning has made the trees stocky and vigorous.
22. Lack of pruning on these peach trees has caused the bearing wood to be formed at the extremities of the branches.
23. Improper pruning has produced a tree with all the bearing wood at the extremities of the branches.
24. The first season's growth of a peach tree after planting.
25. An apple tree before and after being pruned to form the scaffold limbs.
26. The same apple tree with the second season's growth.
27. The third season's growth on an apple tree.
Note the open head.
28. An upright-growing apple tree before and after pruning.
Note how the branches are headed back and an open head formed.
29. Large apple trees with the branches low and well distributed through the tree.
30. A branch of Burbank plums.
Note the heavy bearing nature and need for thinning.
31. Boys thinning plums.
32. Two branches of peaches from the same tree, showing the results of thinning.

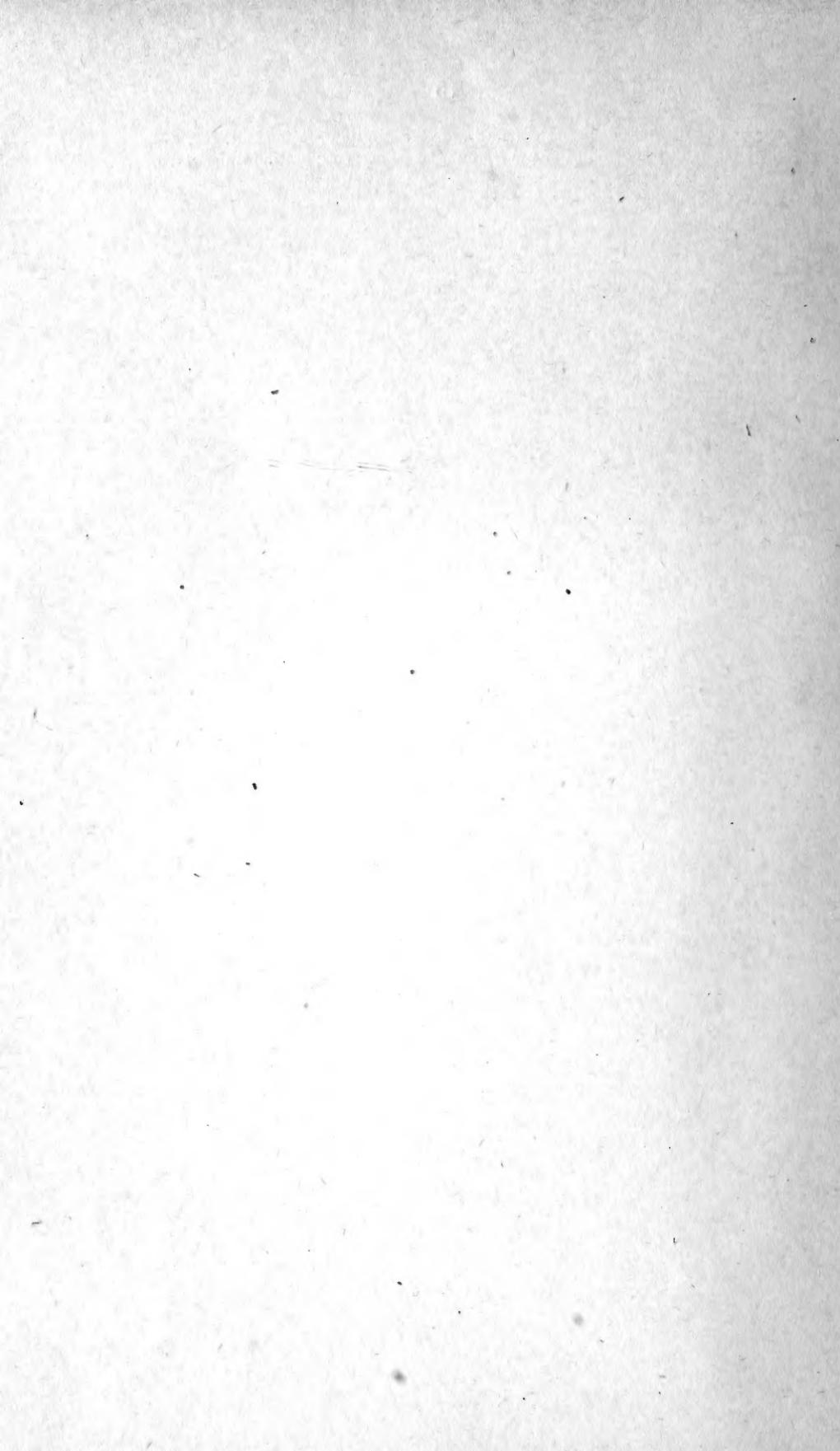
No. of
view.

33. High-headed apple trees that need to be deheaded.
34. The same trees after being deheaded.
35. A peach tree with the bearing wood at the extremities of the branches.
36. The same tree after being cut back to a few short arms.
37. One season's growth on a peach tree after being deheaded.
38. Breaking up the sod in an old orchard.
An important feature in renovation.
39. The stump of an apple tree showing how few feeding roots are near the trunk of the tree.
40. The same stump showing the area covered by the feeding roots of an apple tree.
41. The result of leaf curl and scale injury in a peach orchard.
42. 1.3 per cent wormy and 98.7 per cent sound fruits in 10 bushels of apples from a sprayed tree.
43. Brown-rot damage on peaches from sprayed and unsprayed trees upon arrival on the market.
44. A convenient apparatus for the proper preparation of spray mixtures.
45. Cooking lime-sulphur spray mixture.
46. A suitable spraying outfit for a small orchard.
47. A power sprayer for use in large orchards.
48. How a wound is repaired by bridge grafting.
Note the wound, how the grafts are put on, and how the growth of the grafts in time covers the wound.
49. Several kinds of tree protectors.
50. An apple tree showing the use of carpet as a tree band.

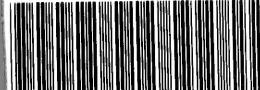
REFERENCES.

1. The Principles of Fruit Growing. By L. H. Bailey.
2. Productive Orcharding. By F. C. Sears.
3. The Apple. By A. E. Wilkinson.
4. Practical Orcharding on Rough Lands. By S. W. Moore.
5. Fruit Growing in the Arid Regions. By W. Paddock and O. B. Whipple.
6. The California Fruits and How to Grow Them. By E. J. Wickson.
7. Plums and Plum Culture. By F. A. Waugh.
8. The Pruning Book. By L. H. Bailey.
9. The Apple and How to Grow It. U. S. Dept. Agr. Farmers' Bul. No. 113.
10. The Profitable Management of the Small Apple Orchard on the General Farm. U. S. Dept. Agr. Farmers' Bul. No. 491.
11. Growing Peaches: Sites, Propagation, Planting, Tillage, and Maintenance of Soil Fertility. U. S. Dept. Agr. Farmers' Bul. No. 631.
12. Growing Peaches: Pruning, Renewal of Tops, Thinning, Interplanted Crops, and Special Practices. U. S. Dept. Agr. Farmers' Bul. No. 632.
13. The Pear and How to Grow It. U. S. Dept. Agr. Farmers' Bul. No. 482.
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22. The Fertilization of Peach Orchards. West Virginia Station Bul. 150.
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32. Apple Growing: Orchard Management. Storrs Conn. Sta. Bul. 66.
33. Commercial Apple Culture in Mountain Regions. North Carolina Dept. of Agr. Vol. 29, No. 8.
34. Irrigation of Orchards. U. S. Dept. Agr. Farmers' Bul. 404.



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